Egger, J.M. 2015. New chromosome counts for selected species of North American *Castilleja* (Orobanchaceae). Phytoneuron 2015-32: 1–5. Published 27 May 2015. ISSN 2153 733X

NEW CHROMOSOME COUNTS FOR SELECTED SPECIES OF NORTH AMERICAN *CASTILLEJA* (OROBANCHACEAE)

J. MARK EGGER
Herbarium, Burke Museum of Natural History and Culture
University of Washington
Seattle, Washington 98195-5325
m.egger@comcast.net

ABSTRACT

New chromosome counts and annotations are presented for 16 species and two additional varieties of *Castilleja* from western North America and Texas. First documented counts are reported for *C. cryptantha*, *C. elmeri*, *C. hyperborea*, *C. miniata* var. *fulva*, *C. pallida* var. *yukonis*, *C. mogollonica*, and *C. suksdorfii*.

This paper reports previously unpublished meiotic chromosome counts for selected species of *Castilleja* from western North America. These counts are based on collections made by the author, and all counts were obtained by the late T.I. Chuang and his wife, F.M. Chuang. These counts were conveyed to me, along with supporting chromosome sketches, by either L.R. Heckard or T.I. Chuang between the years 1985 and 1992, and the supporting correspondence and specimens are on file at WTU and/or UC/JEPS. They are published at this time to provide additional counts for inclusion in the *Castilleja* treatment for the Flora of North America North of Mexico. Some annotation information is also supplied. Methods used to record these counts were outlined most recently in Chuang and Heckard (1993).

Castilleja cryptantha Pennell & G.N. Jones

USA. WASHINGTON. Pierce Co.: flat, fairly lush subalpine meadow, on trail from Sunrise Visitor's Center, just before reaching Shadow Lake, Mt. Rainier National Park, 31 Jul 1988, *Egger 160*, WTU. ***n* = 12**

This is the first published count for this rare endemic of Mt. Rainier National Park and its immediate vicinity.

Castilleja cusickii Greenm.

USA. IDAHO. Caribou Co.: fairly dry pasture/meadow with little or no grazing, adjacent to U.S. Hwy 89, 1.6 km NE of bridge over Ovid Creek, northern Bear Valley, 22 Jun 1990, *Egger 322*, WTU. ***n* = 12**

This count is from an unusual population of *Castilleja cusickii* characterized by pink to violet bracts, in contrast to the typically pale yellow bracts of this species. This diploid count agrees with earlier counts for this species (Heckard & Chuang, 1977).

Castilleja elmeri Fernald

USA. WASHINGTON. Kittitas Co.: drier sites in moist meadows near Cle Elum River, along Forest Service Road 2405 just above Tucquala (Fish) Lake, Wenatchee National Forest, 9 Jul 1988, *Egger 241*, WTU. ***n* = 24**

This is the first published count for this species of mostly serpentine substrates in the central and northern Cascade Mountains of Washington and adjacent southern British Columbia.

Castilleja hyperborea Pennell

CANADA. YUKON. Dry calcareous slopes and ridges at or above timberline, about 1 km W of Dempster Hwy, 130.4 km N of junction with Klondike Hwy, 5 Jul 1991, *Egger 436*, WTU. ***n* = 12**

This is apparently the first report of a chromosome count for *Castilleja hyperborea*.

Castilleja indivisa Engelm. & A. Gray

USA. TEXAS. Johnson Co.: meadowy roadside bank, along U.S. Hwy 67, about 5 km E of Keene, between Keene and Interstate Hwy 35W, 7 Apr 1990, *Egger 314*, WTU. ***n* = 12**

This count agrees with an earlier count of this species by Heckard (1968). It should be noted that the Index to Plant Chromosome Numbers (accessed 8 May 2015) mistakenly includes counts of $n = 14$ and $n = 16$ for *Castilleja indivisa*, with an earlier paper of mine cited as the source (Egger 1994). However, in that paper I included chromosome counts only for hybrid plants involving *C. indivisa* as one of the putative parental species. Those hybrid plants showed large chromosomal irregularities (Chuang, pers. comm., 8 Jul 1990), and the counts obtained from them should not be attributed to *C. indivisa* as a single species.

Castilleja miniata Douglas ex Hook. **var. fulva** (Pennell) J.M. Egger

CANADA. BRITISH COLUMBIA. Roadside ditch, 115th Road, 3.2 km NW of junction with Canadian Hwy 29, N bluff of Peace River, 16.1 km E of Hudson's Hope, 15 Jul 1990, *Egger 378*, WTU. ***n* = ca. 48**

This collection was made in the general vicinity of the type collection of *Castilleja fulva* Pennell, the basionym of this variety. It is the first published count for var. *fulva*.

Castilleja affin. miniata Douglas ex Hook.

CANADA. ALBERTA. Lush, moist roadside field, along Canadian Hwy 2, 8.0 km E of junction with Hwy 735 to Whitelaw, Peace River region, 14 Jul 1990, *Egger 377*, WTU. ***n* = 12**

This count was made from a plant identified as *Castilleja* affin. *miniata* by Heckard in 1990. However, field work in this region has shown that the voucher is typical of what appears to be an undescribed form of *Castilleja* endemic to the Peace River region of west-central Alberta and adjacent British Columbia, Canada. Further inquiry into this entity is ongoing.

Castilleja mexicana (Hemsl.) A. Gray

USA. TEXAS. Jeff Davis Co.: fine gravelly volcanic soil on gentle slope; with low grasses and forbs, pasture on N side of Texas Hwy 17, 1.3 km SW of summit of Wild Rose Pass, NE of Fort Davis, 19 Aug 1991, *Egger 477*, WTU. ***n* = 12**

This confirms earlier counts for *Castilleja mexicana* by Chuang and Heckard (1993) and Ward (1984).

Castilleja mogollonica Pennell

USA. ARIZONA. Apache Co.: narrow band at outer edges of moist creek bottom in meadows along Hall Creek, about 0.8 km S of Arizona Hwy 273, Apache-Sitgreaves National Forest, 16 Aug 1991, *Egger 474*, WTU. ***n* = 12**

This is the first published count for this endemic of subalpine meadows in the White Mountains of east-central Arizona.

Castilleja nelsonii Eastw.

USA. ARIZONA. Apache Co.: moderately dry soil in partial shade of pine forest edges, along secondary forest road just E of Hall Creek and S of Arizona Hwy 273, Apache-Sitgreaves National Forest, 16 Aug 1991, *Egger 472*, WTU. ***n* = 12**

Castilleja nelsonii is the earliest published name for the entity long known as *Castilleja austromontana* Standley & Blumer. The present count confirms earlier chromosome counts for this species (Heckard 1968; Heckard & Chuang 1977).

Castilleja pallida (L.) Spreng. **var. caudata** (Pennell) B. Boivin

CANADA. YUKON. Dry, gravelly roadside, adjacent to the Alaska Hwy, about 12.9 km N of Burwash Landing, 3 Jul 1991, *Egger 425*, WTU. ***n* = ca. 36**

USA: ALASKA. Grassy, brushy, cleared corridor in mixed forest, pipeline corridor about 60 m down a turnoff road from Alaska Hwy, 24.6 km S of Delta Junction, 8 Jul 1991, *J.M. Egger 457*, WTU. ***n* = 36**

The first collection cited above is from a plant in the Kluane Lake region of southern Yukon, where populations of *Castilleja pallida* var. *caudata* appear to mingle with *C. pallida* var. *yukonis*. This plant did not seem to be an intermediate form, though the populations of *C. pallida* in this region merit further study to better understand the limits of both varieties. The second collection is of the form originally described as *Castilleja annua* Pennell, which I now regard as one of the many localized races of this widespread variety.

Previous reports for *Castilleja pallida* var. *caudata* include those of Johnson and Packer (1968) of $n = 48$ and Dawe and Murray (1981) of $n = 12$ and $n = 36$.

Castilleja pallida (L.) Spreng. **var. yukonis** (Pennell) J.M. Egger

CANADA. YUKON. Gravelly slope along road, N bank of Pelly River at Pelly Crossing, 2.1 km W of junction with Klondike Hwy, 7 Jul 1991, *Egger 441*, WTU. ***n* = 24**

This collection is from a location not far from the type locality of *Castilleja yukonis* Pennell, the basionym for *C. pallida* var. *yukonis,* and closely resembles the type collection morphologically. I believe it is the first count for this variety, but this is difficult to determine with certainty, due to the various names assigned to plants of the *C. pallida* complex by a variety of botanists.

Castilleja raupii Pennell

USA. ALASKA. Low brushy edges of *Salix-Picea* thickets around Denali train station and Denali Hotel, near entrance to Denali National Park, 9 Jul 1991, *Egger 449*, WTU. ***n* = 36**

This count for *Castilleja raupii* agrees with those reported earlier by Heckard (1968).

Castilleja septentrionalis Lindl.

USA. NEW HAMPSHIRE. Coos Co.: moist cliffs and rocky slopes of headwall, along trail about 2/3 up headwall of Tuckerman Ravine, Mt. Washington massif, Presidential Range, 10 Aug 1988, *Egger 246*, WTU. ***n* = 12**

The present count samples the eastern form of this widespread species, and it is in accordance with previous reports from that region (e.g.: Löve and Löve, 1982). Existing chromosome reports for this species also include plants of the Rocky Mountains region, but these were reported as the synonymous *Castilleja sulphurea* Rydberg. These reports include counts of $n = 12$, 24, and 48 (Heckard 1968; Heckard & Chuang 1977).

Castilleja suksdorfii A. Gray

USA. WASHINGTON. Skamania Co.: wet meadow with tall grass, Babyshoe Meadow, along Forest Service road to Randle, just W of road junction SW of Takhlakh Lake, Gifford Pinchot National Forest, 16 Jul 1988, *Egger 242*, WTU. ***n* = 36**

This is the first published count for *Castilleja suksdorfii*, but it also matches an as yet unpublished count for this species made from a collection by Heckard from Crater Lake National Park, Oregon, near the southern terminus of the range of this species (Heckard, pers. comm., 2 Jul 1986).

Castilleja thompsonii Pennell

USA. WASHINGTON. Skamania Co.: dry, gravelly, consolidated alpine ridges, flats, and slopes around and above "High Camp," near headwaters of Adams Creek, Mt. Adams Wilderness Area, Gifford Pinchot National Forest, 17 Jul 1988, *Egger 244*, WTU. ***n* = 12**

Previous reports for this species include $n = 12$ and $n = 24$ (Heckard & Chuang 1977). The voucher and count were obtained from the approximate type locality of *Castilleja villicaulis* Pennell & M. Ownbey, a high elevation form of *C. thompsonii* found at timberline and on the lower alpine slopes of Mt. Adams in southern Washington. While the alpine form is somewhat distinctive in its long-villous pubescence and low growth form, *C. villicaulis* is usually regarded as a synonym of *C. thompsonii*. A comprehensive review and genetic study of *C. thompsonii* is needed to determine if the Mt. Adams form in particular is worthy of varietal recognition.

Castilleja unalaschensis (Cham. & Schlt.) Malte

USA. ALASKA. Moist, shady bank along highway; near sea level, Seward Hwy, 6.9 km NW of turnoff for Girdwood, along Turnagain Arm, Seward Peninsula, 10 Jul 1991, *Egger 450*, WTU. ***n* = ca. 48**

Two previous counts for *Castilleja unalaschensis* were reported by Taylor and Mulligan (1968) as $n = 48$ and $n = ca.48$, matching the count presented here.

ACKNOWLEDGEMENTS

I thank David Giblin (WTU) for assistance with specimens and Peter Zika for reviewing two earlier forms of the manuscript. It is also appropriate to express my deep gratitude to Peter and to the members of the Carex Working Group — Barbara Wilson, Dick Brainerd, and Nick Otting — for their invaluable assistance and support in completing the *Castilleja* treatment for the Flora of North America. I also thank the late L.R. Heckard and T.I. Chuang for providing the chromosome counts presented here and for encouragement of my developing interest in the genus *Castilleja*. It should also be noted that Dr. Chuang's wife, Fei-mei Chuang, was instrumental in determining the chromosome counts earlier published by Chuang and Heckard, as well as those presented here, and I express my sincere gratitude to her.

LITERATURE CITED

Chuang, T.I. and L.R. Heckard. 1993. Chromosome numbers of neotropical *Castilleja* (Scrophulariaceae: tribe Pedicularеae) and their taxonomic implications. Ann. Missouri Bot. Gard. 80: 974–989.

Dawe, J.C. and D.F. Murray. 1981. Chromosome numbers of some selected Alaskan vascular plants. Canad. J. Bot. 59: 1373–1381.

Egger, J.M. 1994. New natural hybrid combinations and comments on interpretation of hybrid populations in *Castilleja* (Scrophulariaceae). Phytologia 77: 381–389.

Heckard, L.R. 1968. Chromosome numbers and polyploidy in *Castilleja* (Scrophulariaceae). Brittonia 20: 212–226.

Heckard, L.R. and T.I. Chuang. 1977. Chromosome numbers, polyploidy, and hybridization in *Castilleja* (Scrophulariaceae) of the Great Basin and Rocky Mountains. Brittonia 29: 159–172.

Index to Plant Chromosome Numbers. 1979-2015. P. Goldblatt & D.E. Johnson (eds.). Missouri Botanical Garden, St. Louis.

Johnson C.G., Jr. and J.G. Packer. 1968. Chromosome numbers in the flora of Ogatoruk Creek, N.W. Alaska. Bot. Notiser 121: 403–456.

Löve, A. and D. Löve. 1982. *In* : IOBP chromosome number reports. LXXV. Taxon 31: 344–360.

Taylor, R.L. and G.A. Mulligan. 1968. Flora of the Queen Charlotte Islands. Part 2, Cytological Aspects of the Vascular Flora. Research Branch, Canad. Dept. Agri. Monogr. 4(2).

Ward, D.E. 1984. Chromosome counts from New Mexico and Mexico. Phytologia 56: 55–60.